REMARKS

Claims 1-6 are pending. Claims 1 and 5 are amended. A substitute Abstract is provided herewith. Figs. 7(A) and 7(B) are amended in accordance with the Request for Approval of Drawing Corrections filed herewith. The specification is amended to address minor informalities found therein. No new matter is submitted. Accordingly, entry of the Amendment, the substitute Abstract and the Request for Approval of Drawing Corrections is respectfully requested.

The attached Appendix includes marked-up copies of each rewritten paragraph (37 C.F.R. §1.121(b)(1)(iii)) and claim (37 C.F.R. §1.121(c)(1)(ii)).

The Applicants advise the Examiner that co-pending U.S. Patent Application No. 09/817,187 filed March 27, 2001 and commonly owned by the Assignee of this application, is directed to related subject matter as in this application.

In item 1 of the Office Action, Figs. 7(A) and 7(B) are objected to for lack of appropriate axis labels. By the Request for Approval of Drawing Corrections filed herewith each of Figs. 7(A) and 7(B) are amended responsive to the Office Action. Accordingly, withdrawal of the drawing objections with respect to Figs. 7(A) and 7(B) is respectfully requested.

In item 2 of the Office Action, the Abstract is objected to. A substitute Abstract is provided herewith responsive to the objections cited. Accordingly, withdrawal of the objection to the Abstract is respectfully requested.

In item 3 of the Office Action, the specification is objected to for an inappropriate reference numeral at page 22, line 30. By this Amendment, the specification is amended to address the objection cited as well as to address other minor informalities found therein. Accordingly, withdrawal of the specification objection is respectfully requested.

In item 4 of the Office Action, claim 1 is objected to. By this Amendment, claim 1 is amended responsive to the objection cited. Accordingly, withdrawal of the claim objection to claim 1 is respectfully requested.

In item 6 of the Office Action, claims 1, 5 and 6 are rejected under 35 U.S.C. §102(e) as anticipated by Maaseidvaag et al. (Maaseidvaag) (U.S. Patent No. 6,167,696). The rejection is respectfully traversed.

To maintain a 35 U.S.C. §102 rejection a reference must teach each and every element of the claimed invention. Maaseidvaag fails to do so.

Applicants' invention comprises a device for purifying exhaust gas of an internal combustion engine comprising at least a particulate filter with a catalyst in the exhaust system for absorbing NO_x when the air-fuel ratio is lean and releasing NO_x when the air-fuel ratio is stochiometric or rich, and a catalytic apparatus for purifying NO_x upstream of the particulate filter. When exhaust gas is lean, particulates are trapped on the particulate filter and automatically oxidized and removed. Thus, NO_x is sufficiently purified by both the catalytic apparatus and the particulate filter. None of the art applied teaches, discloses or suggests the combination of features claimed.

Maaseidvaag discloses an exhaust purification system 10 for an internal combustion engine having a three-way catalyst 16 upstream of an HC trap 18 and a still further downstream NO_x trap 22. The three-way catalyst 16 purifies NO_x when the air-fuel ratio is stochiometric or rich, but does not function to absorb NO_x when the air-fuel ratio is lean as in Applicants' invention. Maaseidvaag states the three-way catalyst 16 only functions when it reaches operational temperature (col. 2, lines 34-38) and when discussing NO_x trap 22, indicates during lean operation exhaust gas temperatures can become very low degrading NO_x absorption efficiency (col. 3, lines 30-33). Thus, Maaseidvaag fails to teach, disclose or suggest each and every feature of the claimed invention. Accordingly, withdrawal of the 35 U.S.C. §102(e) rejection of claims 1-5 and 6 is respectfully requested.

In item 8 of the Office Action, claims 1-4 are rejected under 35 U.S.C. §103(a) as unpatentable over Takeshima et al. (Takeshima) (U.S. Patent No. 5,473,890) in view of Maaseidvaag. The rejection is respectfully traversed.

Applicants' invention is discussed in detail above. Likewise, Maaseidvaag is discussed above.

Takeshima fails to overcome the deficiencies of Maaseidvaag at least in that Takeshima fails to even disclose a particulate filter carrying a catalyst for absorbing and reducing NO_x. Thus, Takeshima cannot possibly purify NO_x in a particulate filter according to air-fuel ratios as in the claimed invention.

no argument!

Thus, as neither Takeshima alone, nor Takeshima in combination with Maaseidvaag teaches, discloses or suggests the combination of features claimed, withdrawal of the 35 U.S.C. §103(a) rejection of claims 1-4 is respectfully requested.

In item 9 of the Office Action, claims 1-4 are further rejected under 35 U.S.C. §103(a) as unpatentable over Dou et al. (Dou) (U.S. Patent Application Publication No. 2001/0035006) in view of Maaseidvaag. The rejection is respectfully traversed.

Applicants' invention is discussed in detail above. Likewise, Maaseidvaag is discussed above.

Dou discloses an exhaust catalyst system that, like Takeshima, fails to teach, disclose or suggest a particulate filter having a catalyst for absorbing and reducing NO_x according to air-fuel ratios as recited in claim 1, from which claims 2-4 depend. Thus, Duo fails to overcome the deficiencies of Maaseidvaag as discussed above. Accordingly, as neither Dou alone, nor Dou in combination with Maaseidvaag, teach, disclose or suggest the combination of features claimed, withdrawal of the 35 U.S.C. §103(a) rejection of claims 1-4 on the basis of Dou in view of Maaseidvaag is respectfully requested.

no argument!

Reconsideration of the application is respectfully requested. Applicants submit that the claims presented in view of the remarks made herein patentably distinguish over the art

applied and pose no 35 U.S.C. §112 issues. Accordingly, allowance of claims 1-6 is respectfully solicited.

Should the Examiner determine that anything further is desirable to place the application in even better form for allowance, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

Respectfully submitted,

James A. Oliff
Registration No. 27,075

Dermott J. Cooke
Registration No. 41,685

JAO:DJC/ccs

Attachments:
Appendix
Substitute Abstract

Date: April 30, 2002

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 15-0461

APPENDIX

Changes to Abstract:

The following is a marked-up version of the amended Abstract.

A device for purifying the exhaust gas of an internal combustion engine is disclosed. The device ~~comprises~~ includes a particulate filter arranged in the exhaust system, which ~~carry~~ carries a catalyst for absorbing and reducing NO_x. The catalyst absorbs NO_x when the air-fuel ratio in the surrounding atmosphere thereof is lean and releases the absorbed NO_x to purify NO_x by reduction when the air-fuel ratio is ~~the~~ stoichiometric or rich. The device further ~~comprises~~ includes a catalytic apparatus for purifying NO_x arranged in the exhaust system upstream of the particulate filter, which has an oxidation function.

Changes to Specification:

Page 22, line 21-page 23, line 13:

Fig. 22 shows the structure of the particulate filter 70, wherein Fig. 22(A) is a front view of the particulate filter 70 and Fig. 22(B) is a side sectional view thereof. As shown in these figures, the particulate filter 70 has an elliptic shape, and is, for example, the wall-flow type of a honeycomb structure formed of a porous material such as cordierite, and has many spaces in the axial direction divided by many partition walls 54 extending in the axial direction. One of any two neighboring spaces is closed by a plug ~~53~~ 52 on the exhaust gas downstream side, and the other one is closed by a plug 53 on the exhaust gas upstream side. Thus, one of the two neighboring spaces serves as an exhaust gas flow-in passage 50 and the other one serves as an exhaust gas flow-out passage 51, causing the exhaust gas to necessarily pass through the partition wall 54 as indicated by arrows in Fig. 22(B). The particulates contained in the exhaust gas are much smaller than the pores of the partition wall 54, but collide with and are trapped on the exhaust gas upstream side surface of the partition wall 54 and the pores surface in the partition wall 54. Thus, each partition wall 54 works as a

trapping wall for trapping the particulates. In the present particulate filter 70, in order to oxidize and remove the trapped particulates, an NO_x absorbent and a noble metal catalyst as platinum Pt, which will be explained below, are carried on both side surfaces of the partition wall 54, and preferably also on the pore surfaces in the partition wall 54, by using an alumina or the like.

Page 25, line 8-page 26, line 12:

By the way, the ability for absorbing NO_x in the NO_x absorbent has a limit. Therefore, before the ability saturates, NO_x must be released from the NO_x absorbent. Namely, before a current amount of NO_x absorbed in the particulate filter 70 reaches the limit amount of NO_x that can be absorbed therein, NO_x must be released from the particulate filter and the released NO_x must be reduced and purified. For the purpose, a current amount of NO_x absorbed in the particulate filter must be estimated. In the present embodiment, a map of amounts of NO_x absorbed in the particulate filter per a unit time (A) in the low temperature combustion is predetermined as shown in Fig. 24(A). In the map, amounts of NO_x absorbed in the particulate filter per a unit time (A) are set as functions of a required engine load (L) and an engine speed (N). A map of amounts of NO_x absorbed in the particulate filter per a unit time (B) in the normal combustion is predetermined as shown in Fig. 24(B). In the map, amounts of NO_x absorbed in the particulate filter per a unit time (B) are set as functions of a required engine load (L) and an engine speed (N). Therefore, a current amount of NO_x absorbed in the particulate filter can be estimated to integrate these amounts of NO_x absorbed in the particulate filter per a unit time (A) and (B). Here, when the low temperature combustion takes place in a rich air-fuel ratio, the absorbed NO_x is released and thus an amount of NO_x absorbed in the particulate filter per a unit time (A) become a minus value. In the present embodiment, when the estimated amount of NO_x absorbed in the particulate filter becomes ~~move~~ more than a predetermined permissible value, the low temperature

combustion is carried out at the stoichiometric air-fuel ratio or a rich air-fuel ratio, fuel is injected into the cylinder in the exhaust stroke, or the like, and thus the air-fuel ratio in the surrounding atmosphere of the particulate filter 70 is made stoichiometric or rich to regenerate the particulate filter. This condition is maintained till the regeneration of the particulate filter is finished. The smaller the air-fuel ratio in the surrounding atmosphere is, the shorter the period in which this condition is maintained becomes.

Page 27, lines 20-26:

Thus, if the NO_x absorbent and the noble metal catalyst (which are referred to as a catalyst for absorbing and reducing NO_x below) are carried on the particulate filter, the particulate filter is effective to purify NO_x in the exhaust gas and to prevent blocking of the particulate filter meshes with oxidizing and removing the trapped particulates.

Page 33, line 22-page 34, line 4:

The residual particulates 63 are gradually transformed into carbonaceous matter that can hardly be oxidized. Further, when the exhaust gas upstream surface is covered with the residual particulates 63, the action of platinum Pt for oxidizing NO and SO_2, and the action of the NO_x absorbent 61 for releasing active-oxygen are suppressed. The residual particulates 63 can be gradually oxidized over a relative long period. However, as shown in Fig. ~~28(C)~~27(C), other particulates 64 deposit on the residual particulates 63 one after the other, and when the particulates are deposited so as to laminate, even if they are the easily oxidized particulates, these particulates may not be oxidized since these particulates are separated away from platinum Pt or from the NO_x absorbent. Accordingly, other particulates deposit successively on these particulates 64. That is, when the state where the amount of emitted particulates (M) is larger than the amount of particulates that can be oxidized and removed (G) continues, the particulates deposit to laminate on the particulate filter.

IN THE CLAIMS:

The following is a marked-up version of the amended claims 1 and 5:

1. (Amended) A device for purifying the exhaust gas of an internal combustion engine comprising:

a particulate filter arranged in the exhaust system, which ~~carry~~ carries a catalyst for absorbing and reducing NO_x, said catalyst absorbing NO_x when the air-fuel ratio in the surrounding atmosphere thereof is lean and releasing the absorbed NO_x to purify NO_x by reduction when said air-fuel ratio is ~~the~~ stoichiometric or rich; and

a catalytic apparatus for purifying NO_x arranged in the exhaust system upstream of said particulate filter, which carries said catalyst for absorbing and reducing NO_x ~~has an oxidation function~~.

5. (Amended) A device for purifying the exhaust gas of an internal combustion engine comprising:

a particulate filter arranged in the exhaust system, which carries an oxidation catalyst for absorbing NO_x when the air-fuel ratio is lean and releasing NO_x when the air-fuel ratio is stochiometric or rich; and

a catalytic apparatus for purifying NO_x arranged in the exhaust system upstream of said particulate filter.

Fig.7(A)

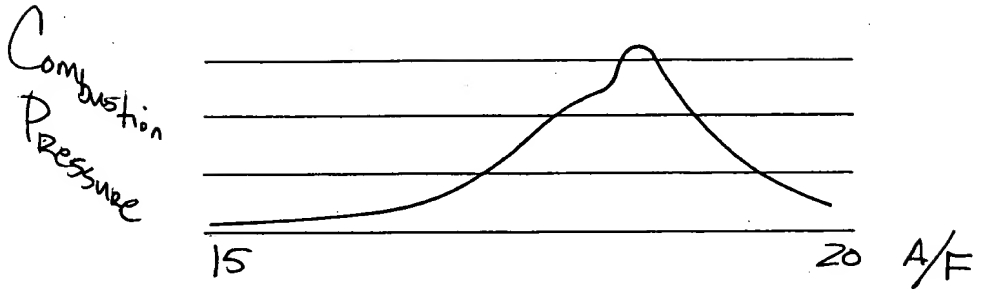
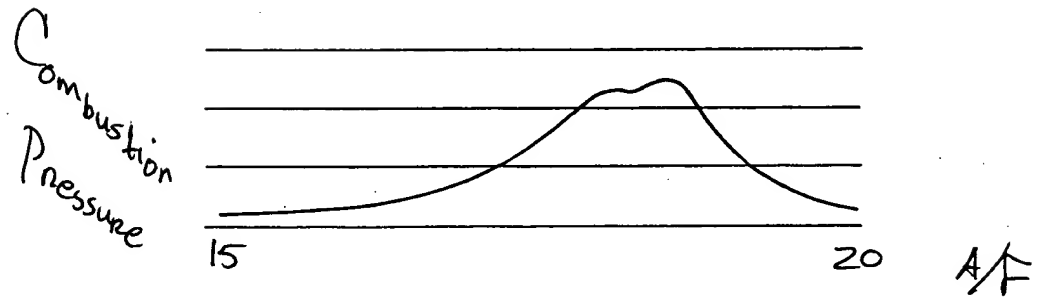


Fig.7(B)



Approved for Entry
5/3/02
TMN